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ing according to most of our notions regarding a pathogenic organism, has likewise not up to the present been proven to be the cause of leprosy, although I am impressed with the probability of such a rôle being eventually attributed to it, and consider that it deserves more serious attention than any strain so far cultivated from the human leprous lesion.

The wide variation in morphology and staining reaction for the culture recovered from the human leprous lesion which subsequently becomes a rapid grower and chromogenic, might account for the interpretations of Kedrowski, Rost, Williams, Bayon and others that *B. lepræ* is a bacterium of such pleomorphism that it can be recognized as a non-acid-fast diphtheroid, or streptothrix, and as an acid-fast bacillus.

CHARLES W. DUVAL

#### THE LAGOMORPHS AN INDEPENDENT ORDER

THE order Rodentia, as at present understood, includes two great groups, or suborders, commonly called the Duplicidentata and the Simplicidentata. Marked distinctions between these groups have long been recognized, yet they have been retained in a single order because of (1) a similar development of large scalpriform incisors and (2) certain similarities in the morphology of the brain and reproductive system which have been regarded as determining relationship. It has been argued<sup>1</sup> that these similarities the more surely denote relationship because of their deep-seated nature. When it is remembered, however, that in development of both brain and reproductive system the groups under discussion are very primitive, differing in these respects but slightly from the Insectivora, Chiroptera, Edentata and Marsupialia, these similarities lose much of their significance, and seem to be far outweighed by the many differences of other early acquired anatomical specializations, especially of the skull and feet. These differences gain in importance when it is considered that, whereas the Simplicidentata are an exceedingly diversified group, both in life

<sup>1</sup> Gregory, *Bull. Amer. Mus. Nat. Hist.*, Vol. 27, p. 325, 1910.

and food habits and consequent morphological modifications, while both groups have an almost world-wide distribution, yet there are no known connecting links or intermediate forms, either living or extinct, even though such forms as the jerboas among the true rodents have outstripped the Lagomorphs in specialization for the leaping mode of progression. Paleontological evidence is admittedly very incomplete, yet so far as it goes it indicates clearly two important facts: first that both groups under discussion are of very ancient origin, the known forms showing but slight modification from the early Oligocene up to the present day, and second that in both groups the scalpriform incisor teeth were very early acquired. The latter fact through early limiting their food habits to a certain degree may account in a large measure for the retention in each group of similar primitive characters. In other and widely differing orders scalpriform incisors have been independently acquired, as in the toxodonts, the pyrotheres, the lemurs (*Daubentonia*, aye-aye), the allothères (*Polymastodon*), the tillodonts and the hyracoids. Even among the artiodactyls a close approximation to this form of incisor has been reached, in the lower jaws, by such forms as the llama and the aberrant goat, *Myotragus*. This character, therefore, is not peculiar to the lagomorphs and rodents, and may very well have been quite independently acquired by these groups. Moreover, certain peculiarities in the structure and development of the incisors in the lagomorphs suggest the truth of this assumption.

Since, therefore in our present state of knowledge there is apparently no good reason for continuing the association of these two great groups of mammals and since, owing to the great number of important differences between them, it is far more convenient for purposes of classification and comparison with other forms to consider them separately, there seems ample reason for placing the Duplicidentata in an independent order. This new order may be called the Lagomorpha, adopting the old subordinal name given to this group by Brandt.

The order may be defined and distinguished from the Rodentia as follows:

#### LAGOMORPHA

Incisors, four above (functional), six in young individuals.

Functional premolars, three above and two below.

Dental formula  $I_1^2$ ,  $Pm_3^3$ ,  $M_3^3$  or  $\frac{2}{3}$  rarely  $\frac{2}{2}$ .

Palate broad, distance between upper tooth rows much greater than the lower.

Upper cheek-teeth much wider than the lower.

Surface of glenoid fossa divided into two parts, an anterior ridge and a posterior pocket, thus limiting the jaws to a lateral motion only in chewing.

Cheek-tooth row in plane with ascending ramus of lower jaw.

Cæcum with spiral fold.

Elbow joint modified, not permitting of rotary motion of the forearm.

Fibula fused with tibia, distally, and articulating with calcaneum.

#### RODENTIA

Incisors, two above, never more than two in young individuals.

Functional premolars never more than one above and one below.

Dental formula  $I_1^1$ ,  $Pm \frac{1 \text{ or } 2}{1}$  or  $\frac{0}{0}$ ,  $M \frac{3}{3}$  or  $\frac{2}{2}$ .

Palate progressively narrow, distance between upper tooth rows less than the lower.

Upper and lower cheek-teeth about equal in width.

Surface of glenoid fossa broad and continuous, permitting both anteroposterior and lateral motion of the jaws in chewing.

Cheek-tooth row lying inside plane of ascending ramus of lower jaw.

Cæcum without spiral fold.

Elbow joint primitive, permitting free rotary motion of the forearm.

Fibula fused or free, distally, but never articulating with the calcaneum.

Other differences than those given above might be added to the list, but these, if properly weighed, seem to suffice. True, some of the characters here given seem trivial, as, for instance, the difference in numbers of the upper incisor teeth. In some groups of mammals this character is not regarded as of more than specific value, but in the groups under

discussion, in the light of other important modifications, it denotes a fundamental difference in the mechanical construction of the dentary system, and thus assumes a far greater importance.

As understood by the writer, both the Lagomorphs and the Rodents represent very ancient orders, whose origin dates so far back in time, and about which so little is known owing to the lack of fossil remains, that their real relationships to other placentals and to each other are at present very uncertain. However, from present evidence the former seem not to stand any closer to the Rodentia than to some other of the great groups of the mammalia. In this connection it is interesting to note some apparently early acquired characters in which the Lagomorphs have paralleled the higher ungulates.<sup>2</sup> The more important of these are: (1) modifications of the dental system, such as (*a*) broad palate with distance between the upper tooth rows much greater than the lower (ruminant), (*b*) upper molariform teeth wider than the lower, (*c*) manner of chewing on one side at a time with a lateral motion of the jaws; (2) modifications of the limbs and feet, (*a*) radius lying anteriorly to the ulna proximally, with articular face extending the full width of the humerus, (*b*) humerus with well-developed intertrochlear ridge, (*c*) fibula articulating strongly with the anterior face of the calcaneum (artiodactyl); (3) dorso-lumbar vertebræ 19 (artiodactyl, rodent).

These characters, while perhaps in no way denoting relationship to the higher ungulates, nevertheless indicate an advance in general development beyond the Rodentia which mark the later as the more primitive order. The existing differences in the brain and reproductive organs seem also to favor this conclusion.

The present article is intended simply to present the principal grounds for establishing a new order for the Lagomorphs, without attempting a full discussion of the subject.

JAMES W. GIDLEY

<sup>2</sup> Some of these characters were pointed out by Cope in 1883, Report U. S. Geological Survey, on Terr., F. V. Haden, Vol. III., p. 813.